**REG.NO:**

**SEMBODAI RUKMANI VARATHARAJAN ENGINEERING COLLEGE**

**ACADEMIC YEAR 2013-2014/ODD SEMESTER**

**MODEL EXAM**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**SUBJECT CODE/TITLE:** ENGINEERING THERMODYNAMICS

**YEAR/SEM:** II/III **DATE:**

**DURATION:** 1 ½ HOURS **MAX.MARKS:** 50

**Answer ALL the Questions**

**PART A (10X2=20)**

1. Differentiate closed and open system.
2. State the Kelvin – Plank statement of second law of thermodynamics
3. What do you mean by “Calusius inequality”?
4. Write the expression for COP of a heat pump and a refrigerator?
5. What is pure substance?
6. Draw the change of phase of water in T-V diagram?
7. State phase rule of pure substances?
8. What are Maxwell relations?
9. What is the relative humidity of air if the DPT and DBT are 25oC and 30oC at 1 atmospheric pressure?
10. What is adiabatic evaporative cooling?

**PART B (80 MARKS)**

1. i) A certain water heater operates under steady flow conditions receiving 4.2 kg/s of water at 75oC temperature, enthalpy 313.93 kJ/kg. The water is heated by mixing with steam which is supplied to the heater at temperature 100.2oC and enthalpy 2676 kJ/kg. The mixture leaves the heater as liquid water at temperature 100oC and enthalpy 419 kJ/kg. How much stem must be supplied to the heater per hour? (8)

ii)Write short notes on

1. reversible and irreversible process (4)
2. Point and Path function (4)

(or)

1. 10 kg of fluid per minute goes through a reversible steady flow process. The properties of fluid at the inlet are 1 P = 1.5 bar, 1 r = 26 kg/m3, 1 v = 110 m/s and 1 u = 910 kJ/kg and at the exit are 2 P = 5.5 bar, 2 r = 5.5 kg/m3 2 v = 190 m/s and 2 k = 710 kJ/kg. During the passage, the fluid rejects 55 kJ/s and rises through 55 m. Determine: (i) the change in enthalpy (h) (ii) work done during the process (16).
2. i) Calculate the decrease in available energy when 25 kg of water at 95oC mix with 35 kg of water at 35oC, the pressure being taken as constant and the temperature of surrounding being 15oC (Cp of water= 4.2 kJ/kg K). (10)

ii) State the Kelvin – Plank statement and Clausius statement of second law of thermodynamics. (6)

(or)

1. A reversible engine is supplied with heat from two constant temperature sources at 900K and 600K and rejects heat to a constant temperature sink at 300K. If the engine executes a numbers of complete cycles while developing 100 kW, and rejecting 3600 kJ of heat per minute. Determine the heat supplied by each source per minute and efficiency of the engine. (16)
2. A large insulated vessel is divided into two chambers, 1 containing 5 kg of dry saturated steam at 0.2 MPa and the other 10 kg of steam, 0.8 quality at 0.5 MPa. If the partition between the chambers is removed and this steam is mixed thoroughly and allowed to settle, find the final pressure, steam quality and entropy change in the process.

(or)

1. A Rankine cycle works between 40 bar and 0.2 bar with saturated steam at turbine inlet. Determine the cycle efficiency and the ratio of pump work and turbine work. (16)
2. A certain ideal gas has R = 290 J/kg k and g = 1.35 (i) Determine the values of p c and v c . (ii) The mass of the gas it is filled in a vessel of 0.5 m3 capacity till the pressure inside becomes 4 bar gauge and the temperature is 27°C (iii) if 40 kJ of heat is given to the vessel when the vessel is closed, determine the resulting temperature and pressure. Take the atmospheric pressure = 100 kPa. (16)

(or)

1. i) Derive Tds relations in terms of temperature and pressure changes and temperature and volume changes. (10)

ii) Describe Joule Kelvin effect with the help of T-p diagram. (6)

1. Saturated air at 20°C at a rate of 70 m3/min is mixed adiabatically with the outside air at 35°C and 50% relative humidity at a rate 30 m3/min. Assuming that the mixing process occurs at a pressure of 1 atm, determine the specific humidity, the relative humidity, the dry bulb temperature, and the volume flow rate of the mixture. (16)

(or)

1. i) With the aim of model psychrometric chart explain the adiabatic mixing and evaporative processes. (10)

ii) Show the process of adiabatic mixing on a sketch of skeleton psychrometric chart and explain the process. (6)